

# Establishment of two new *Anaplecta* species (Blattodea, Blattoidea, Anaplectidae) based on morphological and COI data with an additional description of *Anaplecta furcata* Deng & Che, 2020

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## Abstract

Based on morphological characteristics, including male and female genitalia, combined with DNA barcodes, two new species, *Anaplecta circinalis* Deng & Che, **sp. nov.** and *Anaplecta bihamata* Deng & Che, **sp. nov.**, are described in detail. Additional information on the female genitalia of *Anaplecta furcata* Deng & Che, 2020 is also provided. Photographs of external morphology and caudal anatomy of these species, as well as a key to the Chinese *Anaplecta* species, are provided.

## Keywords

Cockroaches, COI, DNA barcodes, female genitalia, morphology, new species, taxonomy

## Introduction

At present, 112 species of *Anaplecta* have been recorded, widely distributed in Asia, North America, South America, Africa and Oceania (21 species in China) (Beccaloni 2014; Deng et al. 2020; Zhu et al. 2022). As taxonomic research progresses, both

morphological characters including male and female genitalia and DNA barcodes have been applied to the identification of *Anaplecta* species (Deng et al. 2020; Zhu et al. 2022). This has enriched the knowledge of the *Anaplecta* fauna, which shows a rich diversity.

The effective discernment of species using male genitalia was verified in Deng et al. (2020) although subtle intraspecific variation occurred in male genitalia of some *Anaplecta* species. Three cryptic *Anaplecta* species were revealed in Zhu et al. (2022), where they combined male and female genitalia with DNA barcodes. This confirmed the importance of female genitalia in species delimitation of this genus.

Recently, after collecting cockroach specimens in Fujian, Yunnan, Guangdong and Hunan provinces in China, two new *Anaplecta* species were discovered based on morphological characters. This result was then further verified here by using DNA barcodes. In addition, an exhaustive description of the female genitalia of *Anaplecta furcata* was also provided herein.

## Materials and methods

### Morphological study

Sixty-eight specimens from Fujian, Yunnan, Guangdong and Hunan provinces were examined in this study. The genitalia terminology used in this paper mainly follows McKittrick (1964), Roth (1990) and Deng et al. (2020), while veins terminology follows Li et al. (2018).

The measurements are based on the specimens examined. The genitalia were processed with 10% NaOH at 65 °C for 30–35 min for digestion of soft tissues. The genitalia segments were dissected and stored in glycerol, then observed with a Motic K400 stereomicroscope. These segments were then preserved with the remainder of the specimen in ethyl alcohol. Photographs of the genitalia and body were taken with a Leica M205A stereomicroscope and edited with Adobe Photoshop CS6. All type materials are deposited at the Institute of Entomology, College of Plant Protection, Southwest University, Chongqing, China (SWU).

Abbreviations in this paper are as follows:

<b>L1, L2, L3</b>	sclerites of the left phallomere;
<b>L2d</b>	L2 dorsal;
<b>L2v</b>	L2 ventral;
<b>L2vm</b>	median sclerite;
<b>M</b>	media veins;
<b>R1, R2, R3</b>	sclerites of the right phallomere;
<b>CuA</b>	cubitus anterior;
<b>CuP</b>	cubitus posterior.

## PCR amplification and sequencing

Four specimens were used for cytochrome oxidase subunit I (*COI*) sequencing in this study. Total DNA was extracted from the muscle of legs according to the HiPure Tissue DNA Mini Kit (Magen Biotech, Guangzhou). Primers for polymerase chain reaction (PCR) were *COI*-F (5'-CAACYAATCATAAAGANATTGGAAC-3') and *COI*-R (5'-TAAACTTCTG-GRTGACCAAARAATCA-3') (a simple adjustment based on Folmer 1994; Yang et al. 2019). The amplification conditions were as follows: initial denaturation 2 min at 98 °C, followed by 35 cycles of 10 s at 98 °C, 10 s annealing at 49–50 °C, 15 s extension at 72 °C, and a final extension of 2 min at 72 °C; the samples were then held at 8 °C. The PCR products were sequenced by Tsingke Biotechnology Co., Ltd. (Beijing, China).

## Molecular analyses

A total of 62 *COI* sequences were analyzed in this study: four newly-sequenced sequences of our newly described *Anaplecta* species and 55 published sequences of 20 Chinese *Anaplecta* species, and three sequences of *Periplaneta* Burmeister, 1838 (as outgroup) downloaded from GenBank (Table 1). The alignment was then manually corrected by translation into amino acids in MEGA 7 (Kumar et al. 2016). The genetic divergence value was quantified based on the Kimura 2-parameter (K2P) distance model (Kimura 1980). Maximum likelihood (ML) analysis was implemented in IQ-TREE (Nguyen et al. 2015) with 1000 replicates for bootstrap values, after choosing optimal partitioning scheme and substitution models (*COI*\_pos 1, GTR+I+G; *COI*\_pos 2 and *COI*\_pos 3, HKY+I+G) in PartitionFinder v.2.1.1 (Lanfear et al. 2017) with the corrected Akaike Information Criterion (AICc).

## Results

### Morphological delimitation based on external morphology and genitalia

After observing the external morphological and genital characteristics of 42 *Anaplecta* samples from Fujian, Yunnan, Guangdong and Hunan provinces, two new morphospecies and one known species, *Anaplecta furcata*, were identified. One morphospecies can be distinguished by its curled L2vm from other Chinese *Anaplecta* species; while the other is characterized by its hook-shaped L2vm and R1.

### Molecular analysis based on *COI*

In this study, the sequenced length of *COI* excluding the primer was approximately 658bp. Four new *COI* sequences have been deposited in GenBank with accession numbers OP306075 to OP306078 (Table 1). Interspecific *COI* genetic divergence

**Table 1.** Samples of *Anaplecta* species used in the maximum likelihood analyses.

Species	Location (voucher number, gender)	Literature source	GenBank Accession Number
<i>A. circinalis</i> sp. nov.	Pu'er, Yunnan (Anapcircm, ♂)		OP306078
<i>A. circinalis</i> sp. nov.	Pu'er, Yunnan (Anapcircf, ♀)		OP306077
<i>A. bihamata</i> sp. nov.	Shaoyang, Hunan (Anapbiham, ♂)		OP306076
<i>A. bihamata</i> sp. nov.	Shaoyang, Hunan (Anapbihaf, ♀)		OP306075
<i>A. bicruris</i>		Zhu et al. (2022)	OL790029, OL790030, OL790036
<i>A. spinosa</i>		Zhu et al. (2022)	OL790028, OL790038
<i>A. ungulata</i>		Zhu et al. (2022)	OL790031, OL790053, OL790048
<i>A. anomala</i>		Zhu et al. (2022)	OL790032, OL790050
<i>A. serrata</i>		Zhu et al. (2022)	OL790033, OL790047, OL790046
<i>A. bombycina</i>		Zhu et al. (2022)	OL790037, OL790049, OL790034, OL790052
<i>A. longihamata</i>		Zhu et al. (2022)	OL790035, OL790051
<i>A. paraomei</i>		Zhu et al. (2022)	OL790039, OL790045, OL790041, OL790042
<i>A. condensa</i>		Zhu et al. (2022)	OL790040, OL790043, OL790044
<i>A. truncatula</i>		Zhu et al. (2022)	OL790054, OL790055
<i>A. omei</i>		Zhu et al. (2022)	OL790056, OL790057, OL790058
<i>A. omei</i>		Deng et al. (2020)	MT800287
<i>A. corneola</i>		Zhu et al. (2022)	OL790063
<i>A. corneola</i>		Deng et al. (2020)	MT800293, MT800296
<i>A. cruciata</i>		Zhu et al. (2022)	OL790061
<i>A. cruciata</i>		Deng et al. (2020)	MT800303, MT800304
<i>A. basalis</i>		Zhu et al. (2022)	OL790060
<i>A. basalis</i>		Deng et al. (2020)	MT800305, MT800309
<i>A. nigra</i>		Deng et al. (2020)	MT800306
<i>A. staminiiformis</i>		Zhu et al. (2022)	OL790062
<i>A. staminiiformis</i>		Deng et al. (2020)	MT800297, MT800299
<i>A. arcuata</i>		Zhu et al. (2022)	OL790065
<i>A. arcuata</i>		Deng et al. (2020)	MT800307, MT800308
<i>A. strigata</i>		Zhu et al. (2022)	OL790064
<i>A. strigata</i>		Deng et al. (2020)	MT800291, MT800292
<i>A. furcata</i>		Deng et al. (2020)	MT800301, MT800302
<i>A. bicolor</i>		Zhu et al. (2022)	OL790059
<i>A. bicolor</i>		Deng et al. (2020)	MT800310
<i>Periplaneta americana</i>		Jones et al. (2013)	KC617846
<i>Periplaneta fuliginosa</i>		Beeren et al. (2015)	KM577133
<i>Periplaneta australasiae</i>		Yue et al. (2014)	KF640069

ranged from 5.54% (*A. longihamata* and *A. condensa*) to 27.53% (*A. truncatula* and *A. ungulata*) (Table 2). Interspecific *COI* genetic divergence ranges among the two new morphospecies (*A. bihamata* sp. nov. and *A. circinalis* sp. nov.) and other *Anaplecta* species are 13.97–27.53%, and 18.85–24.85% respectively (Table 2). ML analysis revealed that conspecific samples including two new morphospecies (*A. bihamata* sp. nov. and *A. circinalis* sp. nov.) gathered together well to constitute monophyletic groups (Fig. 1), which solidly supported our morphological results.

Taxonomy

Based on the morphology and ML analysis, we confirmed two new species: *Anaplecta circinalis* Deng & Che, sp. nov. and *Anaplecta bihamata* Deng & Che, sp. nov.

**Table 2.** Interspecific genetic distance calculated by the K2P model using *COI* sequences in MEGA.

	species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1	<i>A. bihamata</i> sp. nov.																					
2	<i>A. staminiiformis</i>	0.1397																				
3	<i>A. bicurris</i>	0.1686	0.1827																			
4	<i>A. spinosa</i>	0.1835	0.1764	0.1653																		
5	<i>A. longihamata</i>	0.2177	0.2460	0.2134	0.2222																	
6	<i>A. condensa</i>	0.2121	0.2370	0.2160	0.2131	<b>0.0554</b>																
7	<i>A. paraomei</i>	0.2003	0.2220	0.2037	0.2169	0.0832	0.0881															
8	<i>A. omei</i>	0.1966	0.2202	0.2192	0.2065	0.0779	0.0937	0.0699														
9	<i>A. corneola</i>	0.2078	0.2115	0.1972	0.1975	0.1425	0.1447	0.1437	0.1513													
10	<i>A. nigra</i>	0.1899	0.1904	0.1943	0.2150	0.2318	0.2365	0.2146	0.2277	0.2108												
11	<i>A. basalis</i>	0.1734	0.1875	0.1918	0.1909	0.2417	0.2400	0.2176	0.2202	0.2133	0.2132											
12	<i>A. bicolor</i>	0.2265	0.2215	0.1939	0.2025	0.2211	0.2209	0.2104	0.2207	0.2070	0.2399	0.2246										
13	<i>A. anomala</i>	0.2123	0.2119	0.2159	0.2065	0.2106	0.2154	0.1981	0.1974	0.2157	0.2220	0.2342	0.1972									
14	<i>A. strigata</i>	0.2123	0.2236	0.2077	0.2012	0.2032	0.2100	0.2095	0.2035	0.2004	0.2094	0.2104	0.2071	0.0868								
15	<i>A. serrata</i>	0.2027	0.2287	0.2090	0.2198	0.2366	0.2526	0.2213	0.2144	0.2353	0.2141	0.2124	0.2438	0.1986	0.1852							
16	<i>A. circinalis</i> sp. nov.	0.2014	0.2175	0.2179	0.1885	0.2427	0.2485	0.2236	0.2196	0.2416	0.2368	0.2063	0.2282	0.2145	0.2019	0.2051						
17	<i>A. bombycina</i>	0.2487	0.2423	0.2201	0.2050	0.2269	0.2310	0.2247	0.2198	0.2141	0.2176	0.2530	0.2471	0.2263	0.2216	0.2373	0.2263					
18	<i>A. arcuata</i>	0.1970	0.2339	0.2367	0.2310	0.2258	0.2355	0.2197	0.2291	0.2442	0.2128	0.2364	0.2239	0.2089	0.2100	0.2495	0.2027	0.1925				
19	<i>A. furcata</i>	0.2201	0.2357	0.2133	0.2208	0.2199	0.2419	0.2376	0.2178	0.2284	0.2126	0.2275	0.2128	0.2124	0.2084	0.2059	0.2192	0.1887	0.1867			
20	<i>A. truncatula</i>	0.2025	0.2161	0.2008	0.1961	0.2387	0.2274	0.2187	0.2219	0.2400	0.2395	0.2031	0.2393	0.2405	0.2398	0.2348	0.2099	0.2494	0.2456	0.2334		
21	<i>A. cruciata</i>	0.2087	0.2167	0.2201	0.2258	0.2352	0.2233	0.2359	0.2107	0.2475	0.2291	0.2292	0.2354	0.2228	0.2370	0.2383	0.2230	0.2615	0.2342	0.2362	0.2546	
22	<i>A. unguolata</i>	0.2337	0.2644	0.2720	0.2411	0.2424	0.2503	0.2509	0.2536	0.2349	0.2284	0.2250	0.2569	0.2276	0.2068	0.2628	0.2435	0.2504	0.2374	0.2454	<b>0.2753</b>	0.2571



**Figure 1.** Maximum likelihood (ML) tree derived from *COI* sequences implemented in IQ-TREE with 1000 replicates for bootstrap values.

Key to species of *Anaplecta* in China

[*A. simplex* Shiraki, 1931 is not included because we were unable to collect a sample and only wings were described by the author.]

- 1 Disk of pronotum bicolored .....2
- Disk of pronotum unicolored .....6
- 2 Disk dark and faded gradually or sharply towards the posterior end.....3
- Disk dark with some markings.....4
- 3 Tegmina yellowish brown, 1/3 of the base black (except the lateral margins)...  
.....*A. basalis* Bey-Bienko, 1969
- Tegmina completely yellowish brown (except the lateral margins).....  
.....*A. bicolor* Deng & Che, 2020
- 4 Disk with a pair of blurred longitudinal darker areas.....  
.....*A. bicruris* Zhu & Che, 2022



–	Disk with a lighter blurred centre .....	5
5	Tegmina unicolored .....	<i>A. strigata</i> Deng & Che, 2020
–	Tegmina bicolored, 1/3 of the base darker than remaining parts (except lateral margins and anal field) .....	<i>A. anomala</i> Zhu & Che, 2022
6	Tegmina with obvious markings .....	7
–	Tegmina without obvious markings .....	9
7	Tegmina yellowish brown, with a nearly oval brown spot at CuP .....	<i>A. ungulata</i> Zhu & Che, 2022
–	Tegmina yellowish brown, with a subrectangular black spot at base .....	8
8	R1 needle-shaped .....	<i>A. truncatula</i> Zhu & Che, 2022
–	R1 arc-shaped .....	<i>A. nigra</i> Deng & Che, 2020
9	Male paraprocts with dense spines on curly posterior margin .....	10
–	Male paraprocts not as above .....	13
10	Intercalary sclerite small, nearly filamentous .....	<i>A. condensa</i> Zhu & Che, 2022
–	Intercalary sclerite large, strip-shaped or sheet-like .....	11
11	Right first valvifer arm long, lateral edges folded up .....	<i>A. longihamata</i> Zhu & Che, 2022
–	Right first valvifer arm short, lateral edges not folded up .....	12
12	The posterior margin of anterior arch hip-shaped .....	<i>A. paraomei</i> Zhu & Che, 2022
–	The posterior margin of anterior arch smooth .....	<i>A. omei</i> Bey-Bienko, 1958
13	L1 with a long and curved filamentary structure .....	14
–	L1 with a short and robust uncinata structure .....	<i>A. cruciata</i> Deng & Che, 2020
14	R1 degraded or merged with L2vm .....	15
–	R1 well developed, not merged with L2vm .....	18
15	Male paraprocts specialized, stripe-shaped, with spines on posterior margin .....	<i>A. spinosa</i> Zhu & Che, 2022
–	Male paraprocts unspecialized .....	16
16	The apex of L2v bifurcated, sheet-like .....	17
–	The apex of L2v not bifurcated, shaped like ‘3’ .....	<i>A. bombycina</i> Zhu & Che, 2022
17	One sclerite of R2 serrated .....	<i>A. serrata</i> Zhu & Che, 2022
–	All sclerites of R2 without serration .....	18
18	L2vm slender .....	<i>A. arcuata</i> Deng & Che, 2020
–	L2vm broad .....	<i>A. circinalis</i> Deng & Che, sp. nov.
19	R1 curved .....	20
–	R1 straight, cylindrical .....	<i>A. staminiformis</i> Deng & Che, 2020
20	R1 highly sclerotized, horn-shaped .....	21
–	R1 slightly sclerotized, arc-shaped .....	<i>A. furcata</i> Deng & Che, 2020
21	Right phallomere without special horny structure .....	<i>A. bihamata</i> Deng & Che, sp. nov.
–	Right phallomere with special horny structure .....	<i>A. corneola</i> Deng & Che, 2020

***Anaplecta circinalis* Deng & Che, sp. nov.**

<https://zoobank.org/90ED9DF4-AEE9-4927-8EE8-835ACD03312A>

Figs 2A–I, 4A–C

**Type material. *Holotype*:** CHINA • male; Yunnan Prov., Pu'er County, Xiniuping Scenic Area of Pu'er National Park; 26°36.14'N, 101°5.53'E; 1602 m; 29 Jun. 2021; Jia-Wei Zhang & Jin-Lin Liu leg; SWU-B-AN-0175. ***Paratypes*:** CHINA • 9 males & 14 females; same data as holotype; SWU-B-AN-0176 to 0198.

**Diagnosis.** This species can be easily separated from other Chinese *Anaplecta* species by its curled left phallomere (L2vm).

**Etymology.** The specific epithet '*circinalis*' is derived from the Latin word *circinalis*, referring to the curled L2vm.

**Description. *Measurements* (mm).** **Male:** Pronotum length × width: 1.0–1.3 × 1.8–1.9, tegmina length: 5.0–5.2, overall length: 5.8–6.1. **Female:** Pronotum length × width: 1.2–1.4 × 1.7–2.0, tegmina length: 4.7–5.1, overall length: 5.6–6.2.

**Coloration.** Body dark yellowish brown, eyes black, antennae dark brown. Head yellowish brown (Fig. 2A, B, D). Pronotum dark yellowish brown, lateral borders nearly hyaline (Fig. 2C). Tegmina yellowish brown, lateral borders nearly hyaline (Fig. 2E). Wings with costal field and appendicular field light brown, other parts light brown, veins dark brown (Fig. 2H). Center of abdominal sterna yellowish brown, gradually darkening to edges. Cerci and legs yellowish brown.

**Head and thorax.** Interocular space slightly greater than distance between antennal sockets. Third and fifth maxillary palpi equal in length, longer than fourth; fifth maxillary palpus subelliptical and thicker than other segments (Fig. 2D). Pronotum subelliptical, anterior margin arched, hind margin nearly straight (Fig. 2C).

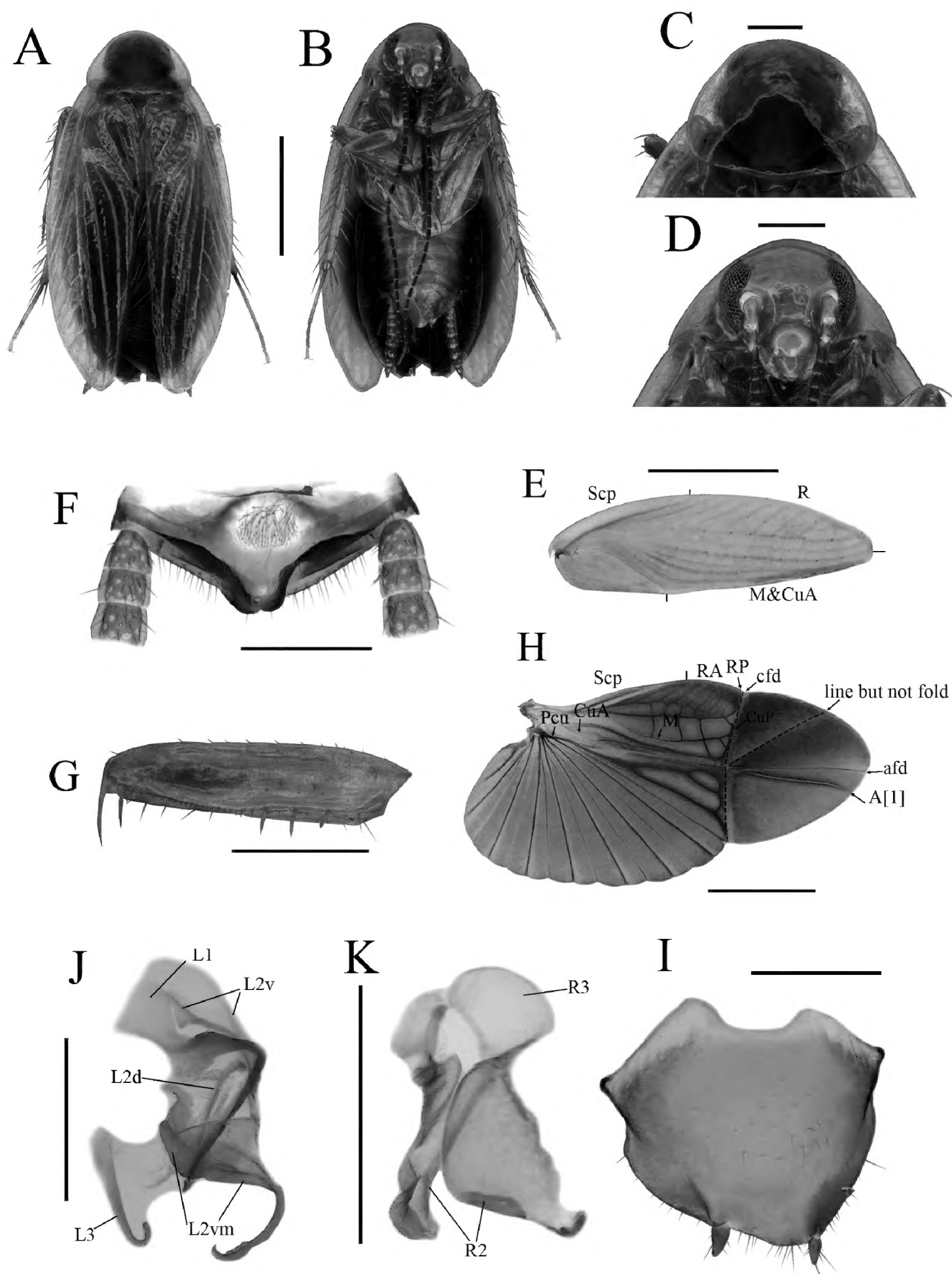
Tegmina with indistinct veins; the radius posterior veins of hind wings slightly indistinct, CuP and CuA merging into one venation (Fig. 2E, H). Front femur type B<sub>2</sub> (Fig. 2G), pulvilli absent, tarsal claws symmetrical, arolia present.

**Male abdomen and genitalia.** Supra-anal plate nearly symmetrical, sheet-like (Fig. 2F). Subgenital plate asymmetrical, interstyler margin arched, with a pair of anterior extensions (Fig. 2I). The left styli more robust than the right. Styli with length about 1/3 of interstyler space (Fig. 2I). Phallomere complex, L1 small, with slender and curved filamentary structure. L2v elongated, slightly bifurcated. L2vm broad, slightly thickened and curved. L2d slender and bifurcated. L3 slender, uncinat part blunt (Fig. 2J). R1 absent. R2 irregular, sheet-like, slightly sclerotized. R3 simple, sheet-like (Fig. 2K).

**Female abdomen and genitalia.** Supra-anal plate nearly symmetrical. Paraprocts (pp.) broad, not extending to the posterior margin of supra-anal plate. Intercalary sclerite (intc.s) nearly stripe-shaped, slightly curved. First valvifer arm short. First valve (v.I) robust. Second valve (v.II) small, basally fused. Third valve (v.III) broad. The anterior margin of anterior arch (aa.) symmetrical, slightly sclerotized, extending forward in a flaky shape with a deep concavity in the middle. Basivalvula (bsv.) nearly flattened, elliptical (Fig. 4A, B). Laterosternal shelf (ltst.sh) slightly sclerotized, lateral margin straight (Fig. 4C).

**Distribution.** China (Yunnan).





**Figure 2.** *Anaplecta circinalis* Deng & Che, sp. nov. holotype, male SWU-B-AN-0175 **A** habitus, dorsal view **B** habitus, ventral view **C** pronotum, dorsal view **D** head, ventral view **E** tegmen **F** supra-anal plate, ventral view **G** front femur **H** wing **I** subgenital plate, dorsal view **J** left phallomere **K** right phallomere, dorsal view. Abbreviations: **afd** anal fold, **A[1]** anterior anal vein, **cfd** cubitus fold, **CuA** cubitus anterior, **CuP** cubitus posterior, **L1**, **L2**, **L3** sclerites of the left phallomere, **L2d** L2 dorsal, **L2v** L2 ventral, **L2vm** median sclerite, **M** median, **Pcu** postcubitus, **R** radius, **RA** radius anterior, **RP** radius posterior, **R2**, **R3** sclerites of the right phallomere, **ScP** subcostal posterior. Scale bars: 2 mm (**A-E**, **G**, **H**); 0.5 mm (**F**, **I-K**).

***Anaplecta bihamata* Deng & Che, sp. nov.**

<https://zoobank.org/01866CE9-D683-4CB2-94C1-5DB812542B74>

Figs 3A–I, 4D–F

**Type material.** *Holotype*: CHINA • male; Hunan Prov., Shaoyang City, Chengbu County, Ten Miles Flat Monitoring Station; 26°14.12'N, 110°25.52'E; 821 m; 22 May 2021; Jing Zhu leg; SWU-B-AN-0199. *Paratypes*: China • 7 males; SWU-B-AN-0200 to 206; same collection data as holotype • 1 male; SWU-B-AN-0207; Guangdong Prov., Shaoguan City • 2 males and 1 female; SWU-B-AN-0208 to 0210; Ruyuan County, Nanling Nature Reserve Xiaozhu Parking Lot; 24°54.10'N, 113°2.53'E; 695 m, 18 May 2021; Wei Han & Li-Min Qiao leg. • 1 male; SWU-B-AN-0211; Hunan Prov., Yongzhou City, Ningyuan County, Mt. Jiuyi, Yellow River Village; 25°9.8'N, 111°34.17'E; 629 m, 6 Jun. 2021; Jing Zhu leg. • 3 males; SWU-B-AN-0212 to 214; Fujian Prov., Wuyishan City, Sisin Integrated Observation Site; 27°35.30'N, 117°46.4'E; 450 m, 23 Jun. 2021; Wei Han & Jing Zhu leg.

**Diagnosis.** This species can be easily separated from other Chinese *Anaplecta* species by its hook-shaped L2vm and R1.

**Etymology.** The specific epithet is derived from the Latin word *hamatus*, referring to both L2vm and R1 being hook-like.

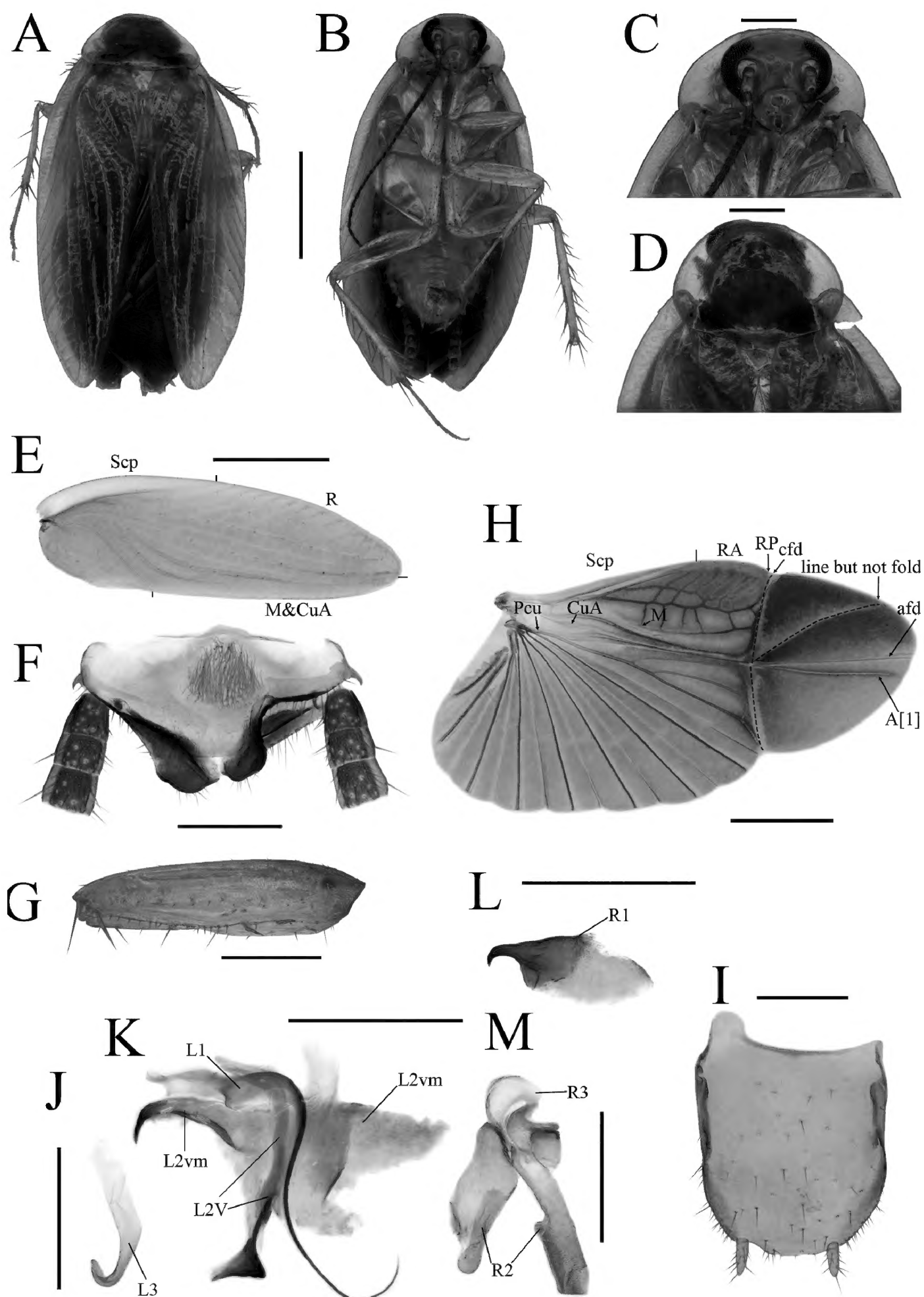
**Description. Measurements (mm).** **Male:** Pronotum length × width: 1.2–1.4 × 1.9–2.0, tegmina length: 5.8–6.4, overall length: 6.8–7.3. **Female:** Pronotum length × width: 1.1–1.4 × 1.9–2.2, tegmina length: 5.4–5.6, overall length: 6.2–6.7.

**Coloration.** Body yellowish brown, eyes black, antennae dark brown. Head yellowish brown (Fig. 3A, B, C). Pronotum and tegmina yellowish brown, lateral borders nearly hyaline (Fig. 3D, E). Wings with costal field and appendicular field infuscated, other parts light brown, with veins dark brown (Fig. 3E, H). Abdominal sterna, cerci and legs yellowish brown (Fig. 3B).

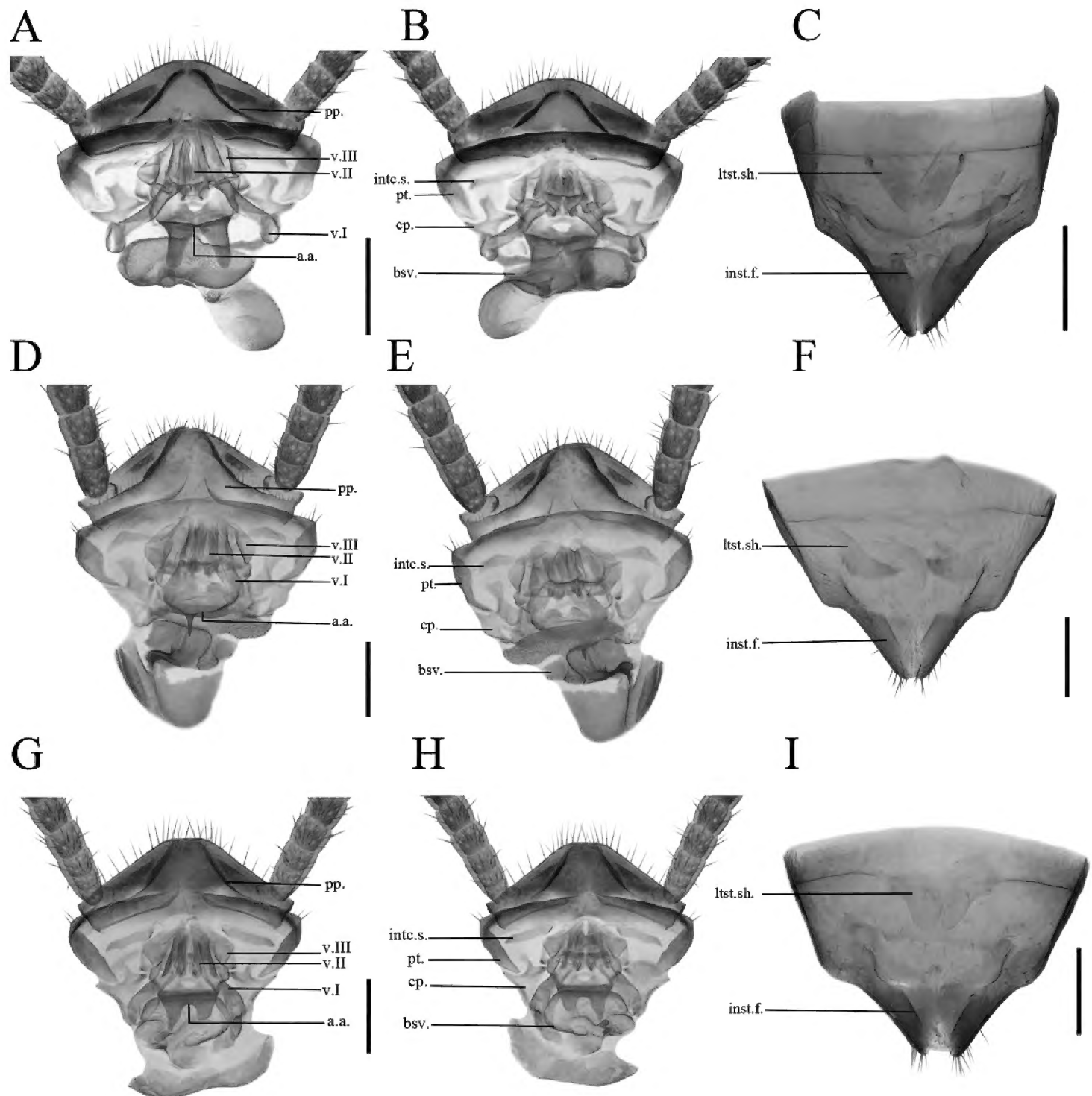
**Head and thorax.** Interocular space slightly greater than distance between antennal sockets. Fourth and fifth maxillary palpi equal in length, shorter than third maxillary palpus; fifth maxillary palpus triangular and thicker than others (Fig. 3C). Pronotum subelliptical (Fig. 3D). Tegmina with indistinct veins; wings with radial veins slightly indistinct, CuP and CuA merging into one venation (Fig. 3E, H). Front femur type B<sub>2</sub> (Fig. 3G), pulvilli absent, tarsal claws symmetrical, arolia present.

**Male abdomen and genitalia.** Supra-anal plate symmetrical, sheet-like (Fig. 3F). Subgenital plate subelliptical, with an anterior extension in the left and the posterior margin slightly arched (Fig. 3I). Styli small, cylindrical, styli with length about 1/3 of interstyler space (Fig. 3I). Phallomere complex, L1 small, with slender and curved filamentary structure. L2v elongated, bifurcated at apex and highly sclerotized at terminal. L2vm broad with curved hook at the left (Fig. 3K). L3 robust and medium, uncinate part with apex blunt (Fig. 3J). R1 hooked, the proximal part sharply tapered and highly sclerotized (Fig. 3L). R2 irregular, slightly sclerotized. R3 short, simple sheet-like (Fig. 3M).

**Female abdomen and genitalia.** Supra-anal plate nearly symmetrical. Paraprocts (pp.) broad, extending to the posterior margin of supra-anal plate. Intercalary sclerite



**Figure 3.** *Anaplecta bihamata* Deng & Che, sp. nov. holotype, male SWU-B-AN-0177 **A** habitus, dorsal view **B** habitus, ventral view **C** pronotum, dorsal view **D** head, ventral view **E** tegmen **F** supra-anal plate, ventral view **G** front femur **H** wing **I** subgenital plate, dorsal view **J, K** left phallomere **L, M** right phallomere, dorsal view. Abbreviations: **afd** anal fold, **A[1]** anterior anal vein, **cfld** cubitus fold, **CuA** cubitus anterior, **CuP** cubitus posterior, **L1, L2, L3** sclerites of the left phallomere, **L2v** L2 ventral, **L2vm** median sclerite, **M** median, **Pcu** postcubitus, **R** radius, **RA** radius anterior, **RP** radius posterior, **R1, R2, R3** sclerites of the right phallomere, **ScP** subcostal posterior. Scale bars: 2 mm (**A–E, G, H**); 0.5 mm (**F, I–M**).



**Figure 4.** **A–C** *Anaplecta circinalis* Deng & Che, sp. nov. paratype, female SWU-B-AN-0176 **D–F** *Anaplecta bihamata* Deng & Che, sp. nov. paratype, female SWU-B-AN-0178 **G–I** *Anaplecta furcata* female SWU-B-B-A060471 **A, D, G** supra-anal plate, ventral view **B, E, H** supra-anal plate, dorsal view **C, F, I** subgenital plate, dorsal view. Abbreviations: **a.a.** anterior arch, **bsv.** basivalvula, **cp.** crosspiece, **pt.** paratergites, **intc.s.** intercalary sclerite, **inst.f.** Intersternal fold, **ltst.sh.** laterosternal shelf, **pp.** paraprocts, **sp.** spermatheca, **v.I** first valve, **v.II** second valve, **v.III** third valve. Scale bars: 2 mm.

(intc.s) short, nearly stripe-shaped, slightly curved. First valvifer arm short. First valve (v.I) robust. Second valve (v.II) small, basally fused. Third valve (v.III) broad. The anterior margin of anterior arch (aa.) slightly sclerotized, with a near spine-shaped protrusion and dense tiny punctuations. Basivalvula (bsv.) nearly flat (Fig. 4D, E). Laterosternal shelf (ltst.sh) slightly sclerotized lateral margin straight (Fig. 4F).

**Distribution.** China (Hunan, Fujian, Guangdong).



***Anaplecta furcata* Deng & Che, 2020**

Fig. 4G–I

*Anaplecta furcata* Deng & Che in Deng et al. 2020: 93–95.

**Description. Measurements (mm). Female:** pronotum length  $\times$  width: 1.1–1.4  $\times$  1.9–2.2, tegmina length: 5.4–5.6, overall length: 6.2–6.7.

**Female abdomen and genitalia.** Supra-anal plate nearly symmetrical. Paraprocts broad, extending to the posterior margin of supra-anal plate. Intercalary sclerite (intc.s) nearly stripe-shaped. First valve (v.I) robust. Second valve (v.II) small, basally fused. Third valve (v.III) broad. The anterior margin of anterior arch (aa.) slightly sclerotized, extending forward in a flaky shape with a deep concavity in the middle. Basivalvula (bsv.) broad, some areas with dense punctuations. Laterosternal shelf (ltst.sh) slightly sclerotized, lateral margin slightly curved.

**Material examined.** CHINA • 2 females; SWU-B-AN-0215 to 216; Guangxi Prov., Jinxiu County, Mt. Dayao; 24°8.43'N, 110°11.70'E; 944 m; 7 Jul. 2015; Lu Qiu & Qi-Kun Bai leg.

**Distribution.** China (Guangxi).

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